

REMARKS

Claims 1-42 and 48-60 are pending. Claims 1, 5-11, 13, 16-17, 20-22, 27-35, 37, 39, 42, 48, 51-52, 54, and 56-59 have been amended for clarity and to better identify the claimed invention.

Claims 1-3, 5, 7-9, 11-12, 19-22, 28-34, 48-49, 51-52, and 56-60 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over JP 09-054828 in the name of Mine et al.¹ in view of JP 08-272980 in the name of Tsukasaki. Applicant respectfully requests reconsideration of this rejection in light of the clarifying claim amendments and following remarks.

As amended, claim 1 recites an image processing apparatus comprising, *inter alia*, “line segment formation means for producing a line segment image, which is distinguished from an image represented by said image data, by forming a plurality of line segments each of which comprises a plurality of pixels and has a line segment length L and a direction corresponding to a direction of the level gradient calculated by said gradient calculation means.”

Mine et al. discloses an image processing system which analyzes similarities between a model image and an “inputted” image. In Mine et al., the similarity between the images is calculated from an edge direction of an inputted image, an edge direction of the model image and a weight related to the model image. In Mine et al., vectors are generated to compare edges of the model image with edges of the subject images. Mine et al. does not teach or suggest “line segment formation means for producing a line segment image.” Instead, the edge-direction unit 16 of Mine et al. sets and stores gradient vectors that are normal to the edges of the model image and the subject image. A difference between the two directions is calculated. The edge magnitude unit 17 “calculates” and stores “edge magnitudes” of the model image. The difference is obtained at each pixel between the directions of the model image and the subject image vector data according. The differences are compared based on the edge magnitude calculated for the model image. See, *inter alia*, col. 6, lines 2-41. In Mine et al., “the edge magnitude of an image” is a vector produced from a model image and an inputted image for calculation of similarities between thereof. col. 6, lines 19-34. The edge magnitude of an image

¹ Applicant notes that U.S. Pat. No. 6,154,566 to Mine et al. corresponds to JP 09-054828 in the name of Mine et al.

never represents an image. While Mine et al. contains disclosure related to producing “edge magnitude of an image” it does not disclose or suggest “producing a line segment image.”

The Mine et al. system produces a “similarity” value, also referred to the “normalized mutual correlation.” If the model image and the inputted image are sufficiently similar, based on a pre-determined threshold, a mark or a character in the inputted image is considered to have been “recognized.” Both images are input to the Mine et al. system, and the result is a similarity value. Mine et al. contains no disclosure related to producing a “line segment image.” The two images of Mine et al. (the model image in particular) are already known prior to the comparison. As described in the Office Action, Mine teaches “producing line segment image data” but does not teach “producing an line segment image.”

Mine et al. also does not disclose or suggest “producing a line segment image, which is distinguished from the image represented by the image data” where the image data is to be processed by the image processing apparatus as claimed in Claim 1.

Tsukasaki discloses a faster method to extract a closed area and perform closed area extraction then previously known methods. Tsukasaki discloses a process which inputs an image of the object used to extract a target, extracts an edge of the object, detects the direction of the edge, detects a target candidate, attaches a label to the object, detects a target from the target candidate and outputs the detected image. In Tsukasaki the closed-region extraction includes a storage section 10, the edge detecting element 20, the extract section 30, and the profile check section 40. The edge detecting element 20 includes a direction edge extract filter of X 22 and the direction edge extract filter of Y 24. The direction edge extract filter of X detects the edge of the direction with respect to X and the direction edge extract filter of Y detects the edge of the direction with respect to Y. In operation, the edge detecting element 20 determines the direction of an edge of the closed area. Tsukasaki does not teach or suggest “line segment formation means for producing a line segment image.”

Claim 1, as amended, is patentable over Mine et al. in view of Tsukasaki. Claims 2-3, 5, 7-9, 11, 12, and 19-22, depend directly, or indirectly, from claim 1 and are also patentable over Mine et al. in view of Tsukasaki for at least the same reasons.

As amended, claim 28 recites an image processing apparatus comprising, *inter alia*, “an image processing means for calculating at least the direction of the level gradient of each of a plurality of processing units in given image data, and producing line segment image including a line segment which comprises a plurality of pixels for each of the plurality of processing units, said image processing means including means for predetermining a line segment length L.”

As noted above, Mine et al. discloses a system for comparing two images. Mine et al. does not teach or suggest “image processing means for calculating at least the direction of the level gradient of each of a plurality of processing units in given image data, and producing line segment image.”

Tsukasaki does not cure the deficiencies of Mine et al. Applicant respectfully submits that Tsukasaki can not properly modify Mine et al. to include “image processing means for calculating at least the direction of the level gradient of each of a plurality of processing units in given image data, and producing line segment image.” Mine et al. requires that a weighting value is calculated from the model image. This weighting value is necessary to the comparison operation performed in Mine et al. The use of the calculated weighting value is central to the purpose of the Mine et al. invention for obtaining a similarity value.

Amended Claim 28 is patentable over the proposed combination of Mine et al. and Tsukasaki. Claims 29-30 depend directly, or indirectly, from claim 28 and so are patentable over Mine et al. in view of Tsukasaki for at least the same reasons.

As amended, claim 31 recites an image processing method comprising, *inter alia*, comprising “producing line segment image representing a line segment which comprises a plurality of pixels for each of the plurality of processing units, each line segment having said predetermined line segment length and a direction corresponding to the calculated direction of the level gradient for each pixel having a non-zero level gradient; and storing the produced line segment image in storage means.”

Mine et al. does not teach or suggest a processing method that includes “producing line segment image representing a line segment which comprises a plurality of pixels for each of the plurality of processing units.”

Tsukasaki does not cure the deficiencies of Mine et al. in that Tsukasaki does not suggest or disclose “producing line segment image representing a line segment which comprises a plurality of pixels for each of the plurality of processing units.” Amended Claim 31 is therefore patentable over the proposed combination of Mine et al. combined with Tsukasaki.

As amended, claim 32 recites a medium storing a program for controlling a computer so as to, *inter alia*, “produce line segment image representing a line segment which comprises a plurality of pixels for each of the plurality of processing units, each line segment having said predetermined line segment length and a direction corresponding to the calculated direction of the level gradient for each pixel having a non-zero level gradient.”

Mine et al. discloses a process for comparing two images, but Mine et al. does not teach or suggest a program for controlling a computer so as to, *inter alia*, “produce line segment image representing a line segment which comprises a plurality of pixels for each of the plurality of processing units, each line segment having said predetermined line segment length and a direction corresponding to the calculated direction of the level gradient for each pixel having a non-zero level gradient.” Tsukasaki does not cure the deficiencies of Mine et al. with respect to amended claim 32. Amended Claim 32 is therefore patentable over the proposed combination of Mine et al. and Tsukasaki.

As amended, claim 33 recites an image processing method comprising, *inter alia*, “producing line segment image representing a line segment which comprises a plurality of pixels for each of the plurality of processing units, each line segment having said predetermined line segment length and a direction corresponding to the calculated direction of the level gradient for each image having a non-zero level gradient; and displaying line segment images represented by the produced line segment image on a display device.”

Mine et al. discloses a process for comparing two images and determining a similarity but does not suggest or disclose an image processing method comprising “producing line segment image representing a line segment which comprises a plurality of pixels for each of the plurality of processing units, each line segment having said predetermined line segment length and a direction corresponding to the calculated direction of the level gradient for each image having a non-zero level gradient.”

Tsukasaki does not cure the deficiencies of Mine et al. with respect to amended claim 33. Tsukasaki discloses a closed area distracting method. The subject matter of claim 33 is not rendered obvious by the proposed combination of Mine et al. and Tsukasaki, and amended claim 33 is patentable over the cited combination.

As amended, claim 34 recites a medium storing a program for controlling a computer so as to, *inter alia*, “produce line segment image representing a line segment which comprises a plurality of pixels for each of the plurality of processing units, each line segment having said predetermined line segment length and a direction corresponding to the calculated direction of the level gradient for each processing unit having a non-zero level gradient; and display line segment images represented by the produced line segment image on a display device.”

Mine et al. teaches a process for comparing two known images based on a difference in edge direction using a weighting value obtained by calculating a vector magnitude of the model image. Mine et al. does not disclose a program that controls a computer to “produce line segment image representing a line segment which comprises a plurality of pixels for each of the plurality of processing units.” Tsukasaki does not cure the deficiency. Amended claim 34 is patentable over Mine et al. combined with Tsukasaki.

As amended, claim 48 recites an image processing apparatus comprising, *inter alia*, “a line segment former which produces line segment image representing a line segment which comprises a plurality of pixels having said line segment length and a direction corresponding to the direction of the level gradient which is calculated by said gradient calculation means.”

Arguments analogous to those advanced above with respect to claims 1, 28, and 31-34 are applicable to claim 48. Mine et al. discloses an image processing apparatus used to compare two images. The differences in edge directions are compared based on a weighting value derived from a vector magnitude calculated for the model image. Mine et al. does not teach or suggest “a line segment former which produces line segment image representing a line segment which comprises a plurality of pixels having said line segment length and a direction corresponding to the direction of the level gradient which is calculated by said gradient calculation means.”

Tsukasaki does not cure the deficiencies of Mine et al. with respect to amended claim 48. Amended claim 48 is patentable over the proposed combination of Mine et al. in view of Tsukasaki.

As amended, claim 56 recites an image processing apparatus comprising, *inter alia*, “line segment formation means for producing line segment image representing a line segment which comprises a plurality of pixels for each of the plurality of processing units.”

Mine et al. *calculates* a vector magnitude for each pixel of a model image. These vector magnitudes are used as weighting values for evaluating differences between edge directions of the model image and an inputted image. Mine et al. does not suggest or disclose “line segment formation means for producing line segment image representing a line segment which comprises a plurality of pixels for each of the plurality of processing units.” Tsukasaki does not cure the deficiency. As amended, claim 56 is patentable over the proposed combination of Mine et al. and Tsukasaki.

As amended, claim 57 recites image processing apparatus comprising, *inter alia*, “line segment formation means for producing line segment image representing a line segment which comprises a plurality of pixels for each of the plurality of processing units, each line segment having a given length and a direction corresponding respectively to the direction of each level gradient which is calculated by said gradient calculation means.”

Arguments analogous to those advanced above with respect to claims 1, 28, 31-34, 48, and 56 are applicable to amended claim 57. Mine et al. discloses an image comparison apparatus in which a calculated vector magnitude is used as a weighting value for comparison of two images. Mine et al. does not teach or suggest “line segment formation means for producing line segment image representing a line segment which comprises a plurality of pixels for each of the plurality of processing units, each line segment having a given length and a direction corresponding respectively to the direction of each level gradient which is calculated by said gradient calculation means.” Amended claim 57 is patentable over the proposed combination of Mine et al. in view of Tsukasaki. Claim 58 depends directly from claim 57 and is patentable over Mine et al. in view of Tsukasaki for at least the same reasons.

As amended, claim 59 recites an apparatus configured and arranged to perform a plurality of types of image processing, including various types of image detection and image recognition. The apparatus comprises, *inter alia*, “line segment formation means for producing line segment image representing a line segment which comprises a plurality of pixels for each of the plurality of processing units, each line segment having a given length and a direction corresponding respectively to the direction of each level gradient which is calculated by said gradient calculation means.”

Mine et al. discloses an image-comparison apparatus. Two images are compared: one is the model and the other is the subject. The edge directions of each figure are compared. A weighting value is provided by calculation of a vector magnitude for the model image. A similarity value is obtained. Mine et al. does not teach or suggest “line segment formation means for producing line segment image representing a line segment which comprises a plurality of pixels for each of the plurality of processing units, each line segment having a given length and a direction corresponding respectively to the direction of each level gradient which is calculated by said gradient calculation means.” Tsukasaki does not cure the deficiencies of Mine et al. Amended claim 59 is patentable over Mine et al. in view of Tsukasaki. Claim 60 depends directly from claim 59 and is patentable over Mine et al. in view of Tsukasaki for at least the same reasons.

Claims 16, 23, 26-27, 35-41, 50, and 53-55 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Mine et al. in view of Tsukasaki and U.S. Pat. No. 5,903,660 to Huang et al. In light of the amendment to claims 1, 16, 23, 26-27, 35-41, and 54, Applicant respectfully requests reconsideration of these rejected claims.

Huang et al. discloses a system for removal of background from projected digital radiograph images which utilizes statistical methods to identify background pixel candidates and probable background edges of a projection digital radiographic image. In Huang et al. statistical results are used to evaluate probable background edges which are then removed.

Claims 16, 23, 26-27, and 50 depend directly or indirectly from amended claim 1. Amended claim 1 is patentable over Mine et al. in view of Tsukasaki, as advanced above. Huang et al. does not cure the deficiencies of Mine et al. in view of Tsukasaki identified above

with respect to claim 1. Amended claim 1 is patentable over Mine et al. in view of Tsukasaki and Huang et al. Claims 16, 23, 26-27, and 50 depend from claim 1 and so are patentable over Mine et al. in view of Tsukasaki and Huang et al. for at least the same reasons.

As amended, claim 35 recites an image processing apparatus comprising, *inter alia*, “means for extracting a plurality of edges whose level gradients are not less than a predetermined value in said image data.”

Neither Mine et al., Tsukasaki, nor Huang et al. suggest or disclose “means for extracting a plurality of edges whose level gradients are not less than a predetermined value in said image data.” As amended, claim 35 is patentable over Mine et al. in view of Tsukasaki and Huang et al. Claim 36 depends from claim 35, and is patentable over Mine et al. in view of Tsukasaki and Huang et al. for at least the same reasons.

As amended, claim 37 recites an inspection apparatus comprising, *inter alia*, “means for calculating at least the direction of the level gradient of each of a plurality of processing units in said input image data, and producing line segment image representing a line segment which comprises a plurality of pixels for each of the plurality of processing units, each line segment having said specified line segment length and a direction corresponding to the calculated direction of the level gradient; and means for detecting the presence or absence of a portion where the line segments are concentrated or are overlapped with one another and the position thereof on the basis of the produced line segment image.”

Neither Mine et al., Tsukasaki, or Huang et al. suggest or disclose “producing line segment image representing a line segment which comprises a plurality of pixels for each of the plurality of processing units.” Amended claim 37 is patentable over the cited art. Claims 38-41 and 54-55 depend directly or indirectly from claim 37, and are patentable over Mine et al. in view of Tsukasaki and Huang et al. for at least the same reasons.

Claim 53 depends from amended claim 31. Amended claim 31 is patentable over the proposed combination of Mine et al. in view of Tsukasaki, as described above. Dependent claim 53 is also patentable over Mine et al. in view of Tsukasaki. Huang et al. does not cure the deficiencies of Mine et al. in view of Tsukasaki. Claim 53 depends indirectly from amended

claim 31, and is patentable over Mine et al. in view of Tsukasaki and Huang et al. for at least the same reasons.

Claims 4 and 10 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Mine et al. in view of Tsukasaki, further in view of U.S. Pat. No. 6,292,582 to Lin et al. Applicant respectfully requests reconsideration of this rejection.

Claims 4 and 10 depend directly, or indirectly, from amended claim 1. Amended claim 1 is patentable over Mine et al. in view of Tsukasaki as advanced above. Claims 4 and 10 depend from amended claim 1 and so are patentable over the proposed combination of Mine et al. in view of Tsukasaki and Lin et al. for at least the same reasons.

Claims 13-15 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Mine et al. in view of Tsukasaki, further in view of U.S. Pat. No. 5,898,440 to Tachibana. Applicant respectfully requests reconsideration of this rejection.

Claims 13-15 depend directly, or indirectly, from amended claim 1. As described above, amended claim 1 is patentable over the proposed combination of Mine et al. in view of Tsukasaki. Claims 13-15 depend from amended claim 1 and so are patentable over the proposed combination of Mine et al. in view of Tsukasaki and Tachibana for at least the same reasons.

Claims 17-18 and 24-25 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Mine et al. in view of Tsukasaki, further in view of U.S. Pat. No. 5,926,557 to King et al. Applicant respectfully requests reconsideration of this rejection.

Claims 17-18 and 24-25 depend directly, or indirectly, from amended claim 1. Amended claim 1 is patentable over the proposed combination of Mine et al. in view of Tsukasaki. Claims 17-18 and 24-25 depend from amended claim 1 and so are patentable over the proposed combination of Mine et al. in view of Tsukasaki and King et al. for at least the same reasons.

Claim 6 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Mine et al. in view of Tsukasaki, further in view of U.S. Pat. No. 6,427,030 to Williams et al. Applicant respectfully requests reconsideration of this rejection.

Claim 6 depends directly from amended claim 1. Amended claim 1 is patentable over the proposed combination of Mine et al. in view of Tsukasaki. Claim 6 is patentable over the proposed combination of Mine et al. in view of Tsukasaki and Williams et al. for at least the same reasons as amended claim 1.

Claim 42 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Mine et al. in view of Tsukasaki and Huang et al., further in view of Tachibana. Applicant respectfully requests reconsideration of this rejection.

Claim 42 depends directly from amended claim 37. Amended claim 37 is patentable over Mine et al. in view of Tsukasaki and Huang et al. as advanced above. Tachibana does not cure the deficiencies of Mine et al. in view of Tsukasaki and Huang et al. Claim 42 is patentable over the proposed combination of Mine et al. in view of Tsukasaki and Huang et al., further in view of Tachibana, for at least the same reasons.

In view of the above amendment, applicant believes the pending application is in condition for allowance.

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Respectfully submitted,

By 

Thomas J. D'Amico

Registration No.: 28,371

Steven War

Registration No.: 48,024

DICKSTEIN SHAPIRO MORIN & OSHINSKY
LLP

2101 L Street NW

Washington, DC 20037-1526

(202) 785-9700

Attorneys for Applicant